

X Marks the Spot - with linear equations!

One interesting feature of the August 21, 2017 total solar eclipse is that its path of totality across the continental US crosses over the paths of earlier and later eclipses.

Each of the crossing points can be determined by fitting a linear equation to pairs of points along each track, and then solving the two equations to find the common, intersection, point. The table below gives the coordinates for the pair of points along the track of the indicated eclipse in columns 2 and 3, and the pair of points along the 2017 eclipse track in the vicinity of the crossing point. Note, west longitudes are represented by negative values.

Date	Points on Track (x,y)		Points on 2017 track (x,y)	
March 27, 1503	-120.3909, 44.5979	-120.0146, 44.6565	-120.5228, 44.665	-119.9789, 44.6298
July 20, 1506	-84.4358, 35.4652	-84.3177, 35.4960	-84.4311, 35.502	-84.3577, 35.4673
February 3, 1562	-120.363, 44.5793	-120.142, 44.6907	-120.315, 44.6525	-120.0273, 44.6335
July 21, 1618	-116.299, 44.3373	-116.069, 44.2655	-116.288, 44.3133	-116.082, 44.2931
October 23, 1623	-82.3516, 34.4652	-82.2205, 34.4889	-82.3533, 34.4969	-82.2517, 34.4465
April 10, 1679	-105.056, 42.4475	-104.882, 42.5335	-105.032, 42.5534	-104.854, 42.5149
May 22, 1724	-106.646, 42.863	-106.486, 42.9746	-106.982, 42.9498	-106.378, 42.8331
June 24, 1778	-82.0044, 34.1958	-81.8732, 34.2543	-81.9336, 34.2883	-81.7688, 34.2054
June 16, 1806	-94.1216, 39.3396	-93.8339, 39.4166	-94.0507, 39.4681	-93.9546, 39.4345
November 30, 1834	-104.432, 42.5221	-104.314, 42.4365	-104.478, 42.4328	-104.241, 42.3801
July 29, 1878	-109.885, 43.5263	-109.734, 43.3992	-109.861, 43.4666	-109.761, 43.4376
January 1, 1889	-111.763, 43.7302	-111.56, 43.8244	-111.8, 43.7647	-111.671, 43.744
May 28, 1900	-81.7427, 34.1474	-81.6363, 34.1974	-81.7556, 34.1986	-81.6626, 34.1523
June 8, 1918	-116.657, 44.3977	-116.465, 44.3285	-116.685, 44.3534	-116.474, 44.333
March 7, 1970	-80.1134, 33.3385	-80.087, 33.3617	-80.1454, 33.3792	-80.0596, 33.3354
April 8, 2024	-89.3028, 37.6203	-89.2653, 37.6434	-89.31, 37.6617	-89.2417, 37.6335
May 11, 2078	-81.6753, 34.1319	-81.5688, 34.1711	-81.6763, 34.1591	-81.5716, 34.1065

Problem 1: Use the Two-Point Formula to create a linear equation in Standard Form for each track

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1} (x - x_1)$$

using the pair of points (x₁,y₁) and (x₂,y₂) along each track.

Problem 2: From the two linear equations in the form $y = mx + b$, solve them for the common intersection point where x is the longitude of the point and y is the latitude of the point.